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SUCTION SYSTEM FOR AN INTERNAL-COMBUSTION ENGINE
[Nainenkikan no Kyūki Sōchi]

Ikuo Mogi
Masanori Namiki
Hironori Ōhashi
Munehiro Kudō

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INVENTOR(S) (72): Ikuo Mogi
Masanori Namiki
Hironori Ōhashi
Munehiro Kudō

APPLICANT(S) (71): UNISIA JECS CO.

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[Claim 1]

A suction system for an internal-combustion engine, comprising:

a lower body integrating an air cleaner bottom case with an open top, a collector bottom case, and multiple manifold lower segments emerging from the collector bottom case;

an upper body integrating an air cleaner open case joined with the open side of said air cleaner bottom case, a collector top case joined with the upper portion of said collector bottom case, and multiple manifold upper segments joined with the upper portions of said manifold lower segments; and

an air cleaner top case, established in a removable manner at the upper portion of said air cleaner open case, covering the corresponding air cleaner open case.

[Claim 2]

A suction system for an internal-combustion engine according to claim 1, in which the manifold lower segments established on said lower body are integrated with the air cleaner bottom case after having been passed through it, while the manifold upper segments established on said upper body are integrated with the air cleaner open case after having been passed through it.

[Claim 3]

A suction system for an internal-combustion engine according to claim 1, in which the manifold lower segments

on said lower body are established to extend in different directions from the collector bottom case and are integrated with the air cleaner bottom case after having been passed through it, and the manifold upper segments on said upper body are established to extend in different directions from the collector top case and integrated with the air cleaner open case after having been passed through it.

[Claim 4]

A suction system for an internal-combustion engine according to claim 1, in which the collector bottom case is established in said air cleaner bottom case and the manifold lower segments on said lower body are passed from the collector bottom case, through the air cleaner bottom case, and integrated with said air cleaner bottom case, and the collector top case is established in the air cleaner open case and the manifold upper segments on said upper body are passed from the collector top case, through the air cleaner open case, and integrated with said air cleaner top case.

[Claim 5]

A suction system for an internal-combustion engine according to claim 1, 2, 3 or 4, in which a throttle attaching portion is established on said upper body in order to mount throttle equipment.

[Claim 6]

A suction system for an internal-combustion engine according to claim 1, 2, 3 or 4, in which a removable filter

is established in the space between said air cleaner open case and said air cleaner top case, and said air cleaner top case is connected to said collector top case via a duct and throttle equipment established on said upper body.

[Claim 7]

A suction system for an internal-combustion engine according to claim 1, 2, 3, 4, 5 or 6, in which an attaching portion for mounting said upper body onto the internal-combustion engine main body and a fuel injection valve mounting hole for mounting the fuel injection valve are established on the ends of said manifold lower segments.

[Detailed Explanation of the Invention]

[0001]

[Field of the Invention]

The present invention pertains to suction systems for internal-combustion engines well-suited to use in induction systems such as automobile engines.

[0002]

[Prior Art]

Generally, suction systems are established in automobile internal-combustion engines in order to suck in intake air from outside into the engine's combustion chamber. Engine suction systems employing such prior art are formed by an air cleaner into which intake air flows, a collector attached to said air cleaner via a duct, and multiple manifolds

that extend from said collector to each engine cylinder.

[0003]

In addition, this suction system is contained inside the automobile's engine room along with the engine main body, and, as the air cleaner is mounted on the inner wall of the engine room via a mounting bracket, the collector and manifolds are mounted on the engine main body.

[0004]

During operation of the engine, intake air from outside flows through the air cleaner and duct and into the collector, whereupon the intake air is sucked from the collector, through the respective manifolds, and into each engine cylinder.

(0005)

Also, when the suction system is established within the engine room during automobile production, the collector and manifolds are first mounted on the engine main body within the engine room, the air cleaner is then mounted on the inner wall of the engine room via a mounting bracket, and, finally, the space between the air cleaner and the collector is connected by a duct.

[0006]

There is other prior art in which the engine suction system is constructed by using a resin material to integrate the air cleaner, collector, and manifolds (published patent number 8-334070).

[0007]

In such cases, each manifold is mounted on the engine main body, and the air cleaner and collector are established on the upper portion of each manifold. In addition, the lower portions of the air cleaner and collector are integrated with the upper surface of each manifold.

[0008]

[Problems to be Solved by the Invention]

In the aforementioned prior art, as the collector and manifolds are mounted on the engine main body within the engine room along with the air cleaner, the space between the air cleaner and the collector is connected by a duct.

[0009]

However, when establishing the suction system within the engine room, collector and manifold mounting must be performed separately from air cleaner mounting. Further, despite the fact that, after mounting, the engine room is crowded with the engine main body, the collector, the manifolds and the air cleaner, the space between the air cleaner and the collector must be connected by a duct.

/3

[0010]

Thus, not only does the prior art's method of mounting the suction system within the engine room take considerable time, the number of suction system parts needed to mount the air cleaner via a mounting bracket within the engine room increases, making it difficult to downsize the suction system.

[0011]

In addition, in other prior art, the air cleaner and collector are established on the upper portions of the manifolds, which increases the height of the suction system and makes it easier for the air cleaner and other members to protrude above the engine main body. This thus requires a relatively large vertical space within the engine room, and in automobiles for which the engine room is shorter, thereby complicating suction system layout.

[0012]

The present invention, having been developed with a focus on the problems described above, hopes to provide a suction system for an internal-combustion engine that allows for compact formation of the air cleaner, collector, and manifolds, more efficient mounting work, reduction in the number of parts, and improvement in layout.

[0013]

[Means to Solve the Problems]

To solve the problems described above, the invention according to claim 1 uses a construction comprising:

a lower body integrating an air cleaner bottom case with an open top, a collector bottom case, and multiple manifold lower segments emerging from the collector bottom case;

an upper body integrating an air cleaner open case joined with the open side of the air cleaner bottom case, a collector top case joined with the upper portion of the collector bottom

case, and multiple manifold upper segments joined with the upper portions of the manifold lower segments; and

an air cleaner top case, established in a removable manner at the upper portion of the air cleaner open case, covering the air cleaner open case.

[0014]

In using such a formation in the assembly of the suction system, the lower and upper bodies are first joined together, and by mounting the air cleaner top case to the upper portion of the air cleaner open case, it is possible to integrate the suction system's air cleaner, collector, and manifolds.

[0015]

Then, in the invention according to claim 2, the manifold lower segments established on said lower body are integrated with the air cleaner bottom case after having been passed through it, while the manifold upper segments established on said upper body are integrated with the air cleaner open case after having been passed through it.

[0016]

This means that because the manifolds may pass through the air cleaner between the air cleaner bottom case and the air cleaner open case, the air cleaner is formed by using the space around each manifold, and both the manifolds and the air cleaner are integrated in a compact fashion.

[0017]

In addition, in the invention according to claim 3, he

manifold lower segments on the lower body are established to extend in different directions from the collector bottom case and are integrated with the air cleaner bottom case after having been passed through it, and the manifold upper segments on the upper body are established to extend in different directions from the collector top case and integrated with the air cleaner open case after having been passed through it.

[0018]

This means that even if the internal-combustion engine's cylinders are situated away from one another, a manifold extending from the suction system's collector towards the respective cylinder is established having been passed through the air cleaner, and both the manifolds and the air cleaner are integrated in a compact fashion

[0019]

Further, in the invention according to claim 4, the collector bottom case is established in said air cleaner bottom case and the manifold lower segments on said lower body are passed from the collector bottom case, through the air cleaner bottom case, and integrated with said air cleaner bottom case, and the collector top case is established in air cleaner open case and the manifold upper segments on said upper body are passed from the collector top case, through the air cleaner open case, and integrated with said air cleaner top case.

[0020]

This means that the collector is established within the air cleaner, making it possible for the manifold to extend from the collector, through the air cleaner, to the outside, and the air cleaner, collector, and manifolds are integrated in a compact fashion.

[0021]

In the invention according to claim 5, a throttle attaching portion is established on said upper body in order to mount throttle equipment.

[0022]

This means that the throttle equipment is mounted on the throttle attaching portion on the upper body, and, for example, the air cleaner and collector are connected via the throttle equipment, thereby making the amount of intake air flowing from the air cleaner to the collector variable.

[0023]

Also, in the invention according to claim 6, a removable filter is established in the space between said air cleaner open case and the air cleaner top case, and the air cleaner top case is connected to the collector top case via a duct and throttle equipment established on said upper body.

[0024]

This means that the intake air is guided from the air cleaner, through the duct and throttle equipment, and to the collector. The amount of intake air may then be controlled

variably by the throttle equipment. The air cleaner top case may also be removed from the air cleaner open case, allowing for filter changes.

/4

[0025]

Furthermore, in the invention according to claim 7, an attaching portion for mounting the upper body onto the internal-combustion engine main body and a fuel injection valve mounting hole for mounting the fuel injection valve are established on the ends of the manifold lower segments.

[0026]

This means that the lower and upper bodies are attached via an attaching portion to the internal-combustion engine main body, allowing for simultaneous mounting of the air cleaner, collector, and manifolds. It is also thus possible to mount the fuel intake valve into the fuel intake valve mounting hole on the manifold lower segment.

[0027]

[Embodiment of the Invention]

The following is an embodiment of the present invention, using Figures 1 through 7 to explain in detail.

[0028]

Figures 1 through 4 show the present invention's first embodiment, which presents an automobile engine suction system as an example.

(0029)

1 is the suction system for an engine (not shown) established within the engine room of an automobile. Said suction system 1 is composed of lower body 2, upper body 8, and air cleaner top case 13, to be described below, and is equipped with air cleaner 14, collector 15, manifolds 16A and 16B, and throttle equipment 24.

[0030]

Here, suction system 1 is constructed for a horizontally-opposed 4 cylinder engine, and manifolds 16A and 16B extend to left and right sides of Figure 1 towards the cylinders (neither shown) located on both ends of the engine main body.

[0031]

2 is the lower body of the lower portion of suction system 1. Said lower body 2, as shown in Figure 4, is integrated with box-type open top air cleaner bottom case 3, made of an injection-molded resin material, open top collector bottom case 4, open top manifold lower segments 5A and 5B, and flange part 7, established on the perimeters of the upper surfaces of these members.

[0032]

5A and 5A are two manifold lower segments extending from collector bottom case 4 to the left in Figure 4, and 5B and 5B are two manifold lower segments extending from the same collector bottom case 4 to the right. Each manifold lower segment 5A and 5B, as shown in Figure 2, has a cross-sectional

circular shape from the base end to a portion of the tip, and the tip portion is formed in a cylindrical fashion.

[0033]

Manifold lower segment 5A, extending to the left, is integrated with the left and right faces of air cleaner bottom case 3 after having the central portion of its longitudinal length passed through said air cleaner bottom case 3, while its tip protrudes from air cleaner bottom case 3 and flexes downwards towards the engine main body.

[0034]

In addition, fuel injection valve mounting holes 5A1 and 5A2 for mounting fuel injection valves (not shown) designed for fuel injection into manifolds 16A and 16B are mounted into on the tips of manifold lower segments 5A and 5B, as shown in Figures 1 and 4.

[0035]

Further, the tips of manifold lower segments 5A and 5B are connected uniformly via attaching portions 6 and 6, which mount lower body 2 on the engine main body, while multiple bolt through holes 6A, 6A, etc. and support parts 6B, 6B, designed for the charging lines supplying fuel to said fuel injection valve, are integrated with each attaching portion 6.

[0036]

7 is a flange part integrated with the upper end of lower body 2. Said flange part 7, as shown in Figures 2 through 4,

is formed to protrude from the upper surfaces of air cleaner bottom case 3, collector bottom case 4, and manifold lower segments 5A and 5B horizontally to the outside.

[0037]

8 is an upper body made from resin material. Said upper body 8, as shown in Figure 4, is integrated with square-shaped air cleaner open case 9, opened at the top and bottom, box-type collector top case 10, opened at the bottom, manifold upper segments 11A and 11B, opened at the bottom, and flange part 12, established on the perimeter of the lower surfaces of these members. As shown in Figure 3, cylindrical throttle attaching portion 10A, which connects with throttle equipment 24, is formed on the sidepiece of collector top case 10 to protrude diagonally upward.

[0038]

11A and 11A are two manifold upper segments extending from collector top case 10 to the left in Figure 1, and 11B and 11B are two manifold upper segments extending from the same collector top case 10 to the right. Each manifold upper segment 11A and 11B, as shown in Figures 1 through 3, has a cross-sectional circular shape.

[0039]

Manifold upper segment 11A, extending to the left, is integrated with the left and right faces of air cleaner open case 9 after having the central portion of its longitudinal length passed through said air cleaner open case 9, while its

tip protrudes from air cleaner open case 9.

[0040]

12 is another flange part integrated with the lower end of upper body 8. Said flange part 12, as shown in figures 2 through 4, is joined with flange part 7 via welding methods such as vibration welding or high-frequency wave welding.

[0041]

13 is a box-type air cleaner top case mounted in a removable fashion on the upper portion of air cleaner open case 9. As shown in Figure 2, said air cleaner top case covers air cleaner case 9.

[0042]

Here, upper body 8 is fixed in an integrated fashion to lower body 8 through flange parts 7 and 12. Air cleaner open case 9 is joined with the open portion of air cleaner bottom case 3, which forms both air cleaner top case 13 and air cleaner 14.

/5

[0043]

In addition, collector top case 10 is joined with the upper portion of collector bottom case 4, which forms collector 15. Further, manifold upper segments 11A and 11B are joined to the upper portions of manifold lower segments 5A and 5B, which completes manifolds 16A and 16B.

[0044]

17 is a filter established within air cleaner 14. The

outer circumference of said filter 17, as shown in Figure 2, is mounted in a removable fashion between air cleaner open case 9 and air cleaner top case 13, which establishes air cleaner 14 in inflow chamber 18 and outflow chamber 19.

[0045]

20 is a J-shaped outside air introduction pipe that introduces outside air into inflow chamber 18 as intake air. Said outside air introduction pipe 20, made of a member different from air cleaner bottom case 3 and air cleaner open case 9, is adhered to the sidepiece of air cleaner 14.

[0046]

21 is an L-shaped duct connecting air cleaner 14 and a side of collector 15. One end side of said duct 21, as shown in Figure 3, is connected to air cleaner top case 13 via attaching band 22 and is in communication with the inside of outflow chamber 19 of air cleaner 14. Also, the other end side of duct 21 is connected to throttle equipment 24 via attaching band 23.

[0047]

24 is throttle equipment used to increase and decrease the amount of engine intake air. Said throttle equipment 24, as shown in Figures 1 and 3, is opened and closed in response to the amount of manipulation of tubular housing 24A and the automobile's accelerator, and has a valve body 24B, which changes the amount of intake air flow through said housing 24A. The inflow side of housing 24A is connected to duct 21

using attaching band 23, while the outflow side is connected to collector top case 10's throttle attaching portion 10A by bolts 25.

[0048]

Thus suction system 1, with air cleaner 14 connected to manifolds 16A and 16B via duct 21, throttle equipment 24, and collector 15, and the end sides of manifolds 16A and 16B connected to each engine cylinder, is mounted on the engine main body by attaching portions 6 on lower body 2. Also, air cleaner 14 is supported in an integrated fashion by each manifold 16A.

[0049]

Automobile engine suction system 1, according to the present embodiment, has the construction described above. The following is an explanation of the system's operation.

[0050]

First, as throttle equipment 24's valve body 24 opens during engine operation, as shown by arrow A in Figure 2, intake air from the outside flows through outside air introduction pipe 20 and into air cleaner 14's inflow chamber 18, is cleaned by filter 17, and flows out into outflow chamber 19. Next, as shown in Figure 3, this intake air flows from air cleaner 14, through duct 21 and throttle equipment 24 in the direction of arrow B, and into collector 15.

[0051]

Further, after the intake air in collector 15 flows,

as shown by arrow C, on one hand through each manifold 16A while on the other hand through each manifold 16B, the intake air is sucked into each engine cylinder. In addition, fuel from the fuel injection valves mounted into fuel injection valve mounting holes 5A1 and 5A2 on manifold lower segments 5A and 5B is sprayed into the intake air.

[0052]

Meanwhile, during the assembly of suction system 1, after joining lower body 2's flange part 7 and upper body 8's flange part 12 via vibration welding, as shown in Figure 4, air cleaner top case 13 and filter 17 are mounted on the upper portion of air cleaner open case 9.

[0053]

Next, as shown in Figure 1, one end side of duct 21 is connected to air cleaner top case 13 via attaching band 22 and the other end of duct 21 is connected to the inflow side of throttle equipment 24 via attaching band 23 while the outflow side of throttle equipment 24 is connected to throttle attaching portion 10A on collector top case 10 via bolts 25. Furthermore, outside air introduction pipe 20 is mounted on the sidepiece of air cleaner 14.

[0054]

Then, when establishing suction system 1 within the engine room, the system is established with lower body 2, upper body 8, and air cleaner top case 13 already mounted, and bolts for mounting (not shown) are screwed into the engine main body

through bolt through holes 6A on lower body 2 (attaching portion 6).

[0055]

With that, in the present embodiment, suction system 1 is constructed by:

lower body 2, having air cleaner bottom case 3, collector bottom case 4, and manifold lower segments 5A and 5B;

upper body 8, having air cleaner open case 9, collector top case 10, and manifold upper segments 11A and 11B; and

air cleaner top case 13.

Thus, in assembling suction system 1, lower body 2 and upper body 8 are joined together, and, by just mounting air cleaner top case 13 on the upper portion of air cleaner open case 9, it is possible to integrate air cleaner 14, collector 15, and manifolds 16A and 16B easily.

[0056]

When establishing suction system 1 in the engine room, after assembling duct 21 and throttle equipment 24 on lower body 2 and upper body 8, by just fixing lower body 2's attaching portions 6 to the engine main body with bolts, it is possible to simultaneously mount air cleaner 14, collector 15, and manifolds 16A and 16B on the engine main body, improving assembly and mounting efficiency for suction system 1.

/6

[0057]

Also, as each manifold 16A has been passed through air

cleaner 14's inflow chamber 18 and integrated with said air cleaner 14, the small spaces between manifolds 16A, which often go to waste, are used as intake chamber 18 inside air cleaner 14. Furthermore, as air cleaner 14 and manifold 16A can be formed easily, suction system 1 can be vertically downsized.

[0058]

This means that in using suction system 1 with, for instance, a horizontally-opposed engine, even when manifolds 16A and 16B extend widely to the left and right within the engine room, the layout of air cleaner 14 within the engine room can be arranged simply.

[0059]

Meanwhile, manifolds 16A and 16B, mounted on the engine main body, provide stable support for air cleaner 14, making the traditional use of attaching brackets mounted within the engine room to support the air cleaner unnecessary and reducing the number of suction system 1 parts.

[0060]

In addition, with filter 17 established in a removable matter between air cleaner open case 9 and air cleaner top case 13, filter changes may be performed by removing air cleaner top case 13 from air cleaner open case 9, improving maintenance.

[0061]

Further, with air cleaner top case's outflow chamber

19 connected to collector 15 via duct 21 and throttle equipment 24, the intake air flow passage from air cleaner 14 to manifolds 16A and 16B is formed in a comparatively more narrow fashion, allowing for simpler assembly of throttle equipment 24 on suction system 1, helping to downsize suction system 1, and improving assembly.

[0062]

In addition, with fuel injection valve mounting holes 5A1 and 5B1 established the ends of manifold lower segments 5A and 5B and support parts 6B established on attaching portions 6, after mounting suction system 1 on the engine main body, it is possible to mount the fuel injection valves and the charging lines for supplying fuel to the fuel injection valves on the engine main body easily.

[0063]

Further, with lower body 2 and upper body 8 formed of resin material and joined in an integrated fashion through flange parts 7 and 12 via vibration welding, it is possible to fix together lower body 2 and upper body 8, having more complicated configurations, more easily.

[0064]

Next, Figures 5 and 6 show the present invention's second embodiment, characterized by the fact that the collector is situated within the air cleaner. Because the second embodiment shares structural elements and codes with the first embodiment, corresponding explanations are removed.

[0065]

31 is this embodiment's suction system for an engine. In the same way as the first embodiment's suction system, aid suction system 31 is composed of lower body 32, upper body 36, and air cleaner top case 40. However, in the present embodiment, collector 42, to be described below, is established within air cleaner 41.

[0066]

32 is the lower body, made along with upper body 36 of a resin material. Said lower body 32, as shown in Figure 6, is integrated with air cleaner bottom case 33, collector bottom case 34, and four manifold lower segments 35, which extend from collector bottom case 35 to the left and right in Figure 5.

[0067]

Here, collector bottom case 34 is established within air cleaner bottom case 33, and each manifold lower segment 35 is integrated with the sidepiece of air cleaner bottom case 33 after having been passed through said air cleaner bottom case 33.

[0068]

36 is the upper body, joined onto lower body 32. Said upper body 36 is integrated with air cleaner open case 37, collector top case 38, and four manifold upper segments 39. Collector top case 38 is established within air cleaner open case 37, and each manifold upper segment 39 is integrated with

the sidepiece of air cleaner open case 37 after having been passed through said air cleaner open case 37.

[0069]

In addition, cylindrical throttle attaching portion 38A, which connects to throttle equipment 24, is formed on the sidepiece of collector top case 38. Said throttle attaching portion 38A protrudes to the outside from air cleaner open case 37.

[0070]

40 is the air cleaner top case, mounted in a removable fashion on air cleaner open case 37. As shown in Figure 6, a duct 45 connection port 40A, to be described below, is formed on said air cleaner top case 40.

[0071]

Here, like the first embodiment, air cleaner top case 40, along with air cleaner bottom case 33 and air cleaner open case 37, constructs air cleaner 41, while collector bottom case 34, along with collector top case 38, constructs collector 42. Also, manifold lower segments 35, along with manifold upper segments 39, make up manifolds 43. Further, filter 44 is established in air cleaner 41.

[0072]

45 is the duct which connects air cleaner 41 and collector 42. One end side aid duct 45 is connected to duct connection port 40A on air cleaner top case 40 and is in communication with air cleaner 41. The other end side of duct

45 is flexed into a U-shape and connected to throttle equipment 24 via bolts 47.

/7

[0073]

Thus, the present embodiment constructed in the above fashion provides almost the same effects as said first embodiment, allowing compact formation of air cleaner 41, collector 42 and manifolds 43 and contributing to the downsizing of suction system 31.

[0074]

In the present embodiment in particular, heat from the engine main body moving to collector 42 and manifolds 43 is blocked by air cleaner 41 and engine performance is improved as the heat is cooled effectively. In addition, outside air introduction pipe 20 may be established on the right side of duct 45 and flexed and extended to the right, improving the degree of freedom for the layout.

[0075]

As shown by the transformation example of the second embodiment in Figure 7, L-shaped duct passage 40B is integrated with suction system 31's air cleaner top case 40, meaning that duct 45 may be eliminated from the construction.

[0076]

In such cases, duct passage 40B is opened downwards while collector top case's throttle attaching portion 38A is opened upwards and formed in an L-shape, and throttle equipment 24

is connected vertically in the space between duct passage 40B and throttle attaching portion 38A

[0077]

This means that the number of parts pertaining to duct 45 and the amount of assembly may be reduced, and suction system 31 may be formed in a compact way in relation to the left-right direction in Figure 7.

[0078]

In each of the said embodiments, outside air introduction pipe 20 is formed separately from air cleaners 14 and 41, but in the present invention, outside air introduction pipe 20 may also be integrated in a vertically segmented fashion with air cleaner open cases 9 and 37 or air cleaner bottom cases 3 and 33 and formed at the same time as lower bodies 2 and 32 are joined with upper bodies 8 and 36.

[0079]

In addition, in each of the said embodiments, throttle equipment 24's valve body 24B is opened and closed in response to the operation of the accelerator, but in the present invention, throttle equipment 24 may also be constructed in an electrically-controlled fashion so that accelerator operation is detected electrically and valve body 24B is driven by a motor.

[0080]

Furthermore, in each of the said embodiments, the fuel injection valves are mounted into the fuel injection valve

mounting holes 5A1 and 5B1 on manifold lower segments 5A, 5B and 35 to inject fuel into manifolds 16A, 16B and 43, but in the present invention, fuel injection valve mounting holes 5A1 and 5B1 on manifold lower segments 5A, 5B and 35 may be eliminated so that, for instance, fuel is injected directly into each engine cylinder.

[0081]

In addition, in each of the said embodiments, suction systems 1 and 31 are constructed in such a way that lower bodies 2 and 32 are established at the bottom of the figures and upper bodies 8 and 36 are established at the top of the figures, but suction systems 1, 31 and 31' formed with integrated lower bodies 2 and 32 and upper bodies 8 and 36 may be positioned in any way, vertically or horizontally, in relation with the internal-combustion engine, thereby eliminating any limitations on the arrangement of suction systems 1, 31, or 31'.

[0082]

In each of the said embodiments, flange part 6 on lower bodies 2 and 32 is joined to flange part 12 on upper bodies 8 and 36 via vibration or high-frequency welding methods, but in the present invention, the two may also be joined via adhesive bonding.

[0083]

Also, in each of the said embodiments, a horizontally-opposed 4 cylinder engine was used as the example

for suction systems 1, 31, and 31', but in the present invention, the suction system may be used with parallel cylinder types, V-engines, 2 and 3 cylinder engines, and engines with 5 or more cylinders.

[0084]

Further, in each of the said embodiments, an automobile engine was used as the example for suction systems 1, 31, and 31', but in the present invention, the suction system may be applied to internal-combustion engines for agricultural, industrial, and other types of machinery.

[0085]

[Effects of the Invention]

As described above, the invention according to claim 1 is formed by a lower body, an upper body, and an air cleaner top case, making it possible to integrate the suction system's air cleaner, collector, and manifolds easily. By performing mounting work for the suction system on the lower body, it is possible to perform mounting work on the air cleaner, collector, and manifolds at the same time, thereby greatly improving suction system assembly time and workability during mounting. Also, integrating the air cleaner, collector, and manifolds allows for compact formation, reduction in the number of parts, and improvement in layout.

[0086]

Also, in the invention according to claim 2, the manifold lower segments are integrated with the air cleaner bottom case

after having been passed through the air cleaner bottom case and the manifold upper segments are configured in an identical fashion, so the space surrounding the manifolds can be used for the air cleaner, thereby allowing for compact formation of the air cleaner and manifolds. The manifolds attached to the main body of the internal-combustion engine may also support the air cleaner, thereby eliminating the need for mounting brackets for the air cleaner, reducing the number of suction system parts, and minimizing the amount of mounting work.

/8

[0087]

In addition, in the invention according to claim 3, the manifold lower segments extend in different directions from the collector bottom case, with segments in one direction integrated with the air cleaner bottom case after having been passed through said air cleaner bottom case, and manifold upper segments configured in an identical fashion, so, even in cases where the manifolds are extended widely to match the specifications of the internal-combustion engine, it is possible to configure the layout of the air cleaner easily and form the air cleaner and manifolds in a compact fashion.

[0088]

Furthermore, in the invention according to claim 4, the manifold lower segments are integrated with the air cleaner bottom case after having been passed from the collector bottom

case inside the air cleaner bottom case and through the air cleaner bottom case itself, while the collector top case and manifold upper segments are configured in an identical fashion, so it is possible to form the air cleaner, collector, and manifolds in a compact fashion. Also, heat from the internal-combustion engine moving to the collector and manifolds is blocked by the air cleaner, thereby enabling effective cooling and improvement of engine performance.

[0089]

The invention according to claim 5 is constructed with a throttle attaching portion designed to mount the throttle equipment on the upper body, so it is possible to mount the throttle equipment on the suction system easily, thereby helping to downsize the throttle equipment-installed suction system and improving assembly efficiency.

[0090]

Also, in the invention according to claim 6, a filter is established in a removable fashion in the space between the air cleaner open case and the air cleaner top case and said air cleaner top case is connected to the collector top case via the duct and throttle equipment, so the filter can be changed easily by removing the air cleaner top case from the air cleaner open case, thereby improving maintenance. Also, the outflow side of the air cleaner and the collector are connected by the duct and the throttle equipment, thereby forming a narrow flow passage for the intake air flowing from

the air cleaner to the manifolds, thereby helping to downsize the suction system and improving assembly efficiency.

[0091]

Furthermore, in the invention according to claim 7, attaching portions for the internal-combustion engine main body and fuel injection valve mounting holes are established on the manifold lower segments, so it is possible to perform air cleaner, collector and manifold mounting efficiently, support the air cleaner with the manifolds in a stable manner, and achieve a significant reduction in the number of suction system parts. In addition, after mounting the suction system on the internal-combustion engine, mounting the fuel injection valves is simple.

[Simple Explanation of the Figures]

[Figure 1] An elevation showing the engine suction system according to the first embodiment

[Figure 2] A vertical cross-section of the suction system seen from the perspective of arrows II-II in Figure 1

[Figure 3] A vertical cross-section of the suction system seen from the perspective of arrows III-III in Figure 1

[Figure 4] An exploded diagram showing a pre-assembly view of the suction system

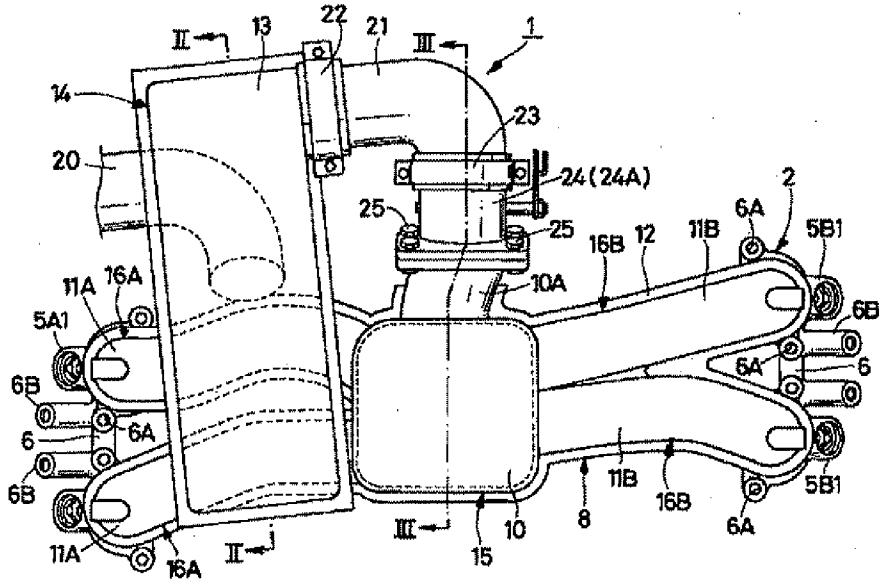
[Figure 5] An elevation showing the engine suction system according to the second embodiment

[Figure 6] A vertical cross-section of the suction system seen from the perspective of arrows II-II in Figure 5

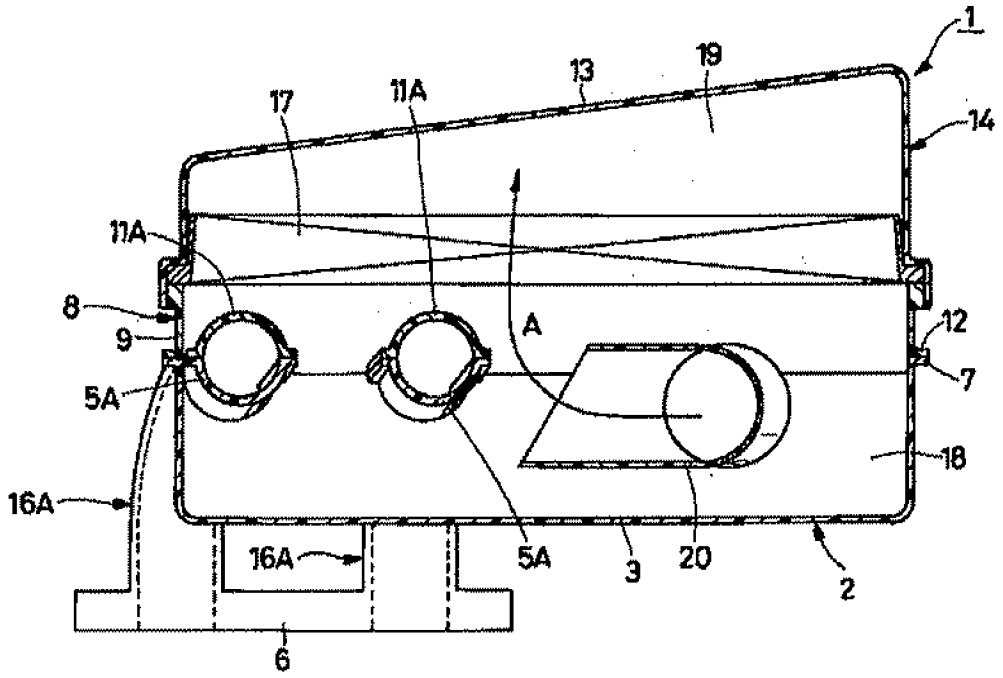
[Figure 7] A vertical cross-section of a transformation example of the second embodiment

[Explanation of Codes]
1, 31, 31': suction system
2, 32: lower body
3, 33: air cleaner bottom case
4, 34: collector bottom case
5A, 5B, 35: manifold lower segments
5A1, 5B1: fuel injection valve mounting hole
6: attaching portion
8, 36: upper body
9, 37: air cleaner open case
10, 38, 38′: collector top case
10A, 38A, 38A′: throttle attaching portion
11A, 11B, 39: manifold upper segments
13, 40, 40′: air cleaner top case
17, 44: filter
21, 45: duct
24: throttle equipment

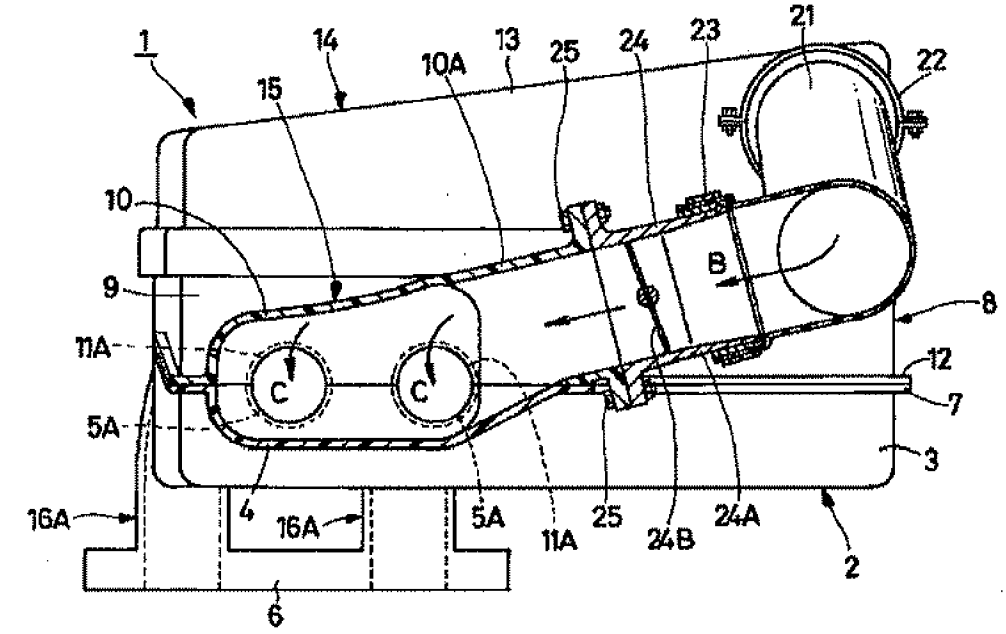
【図１】



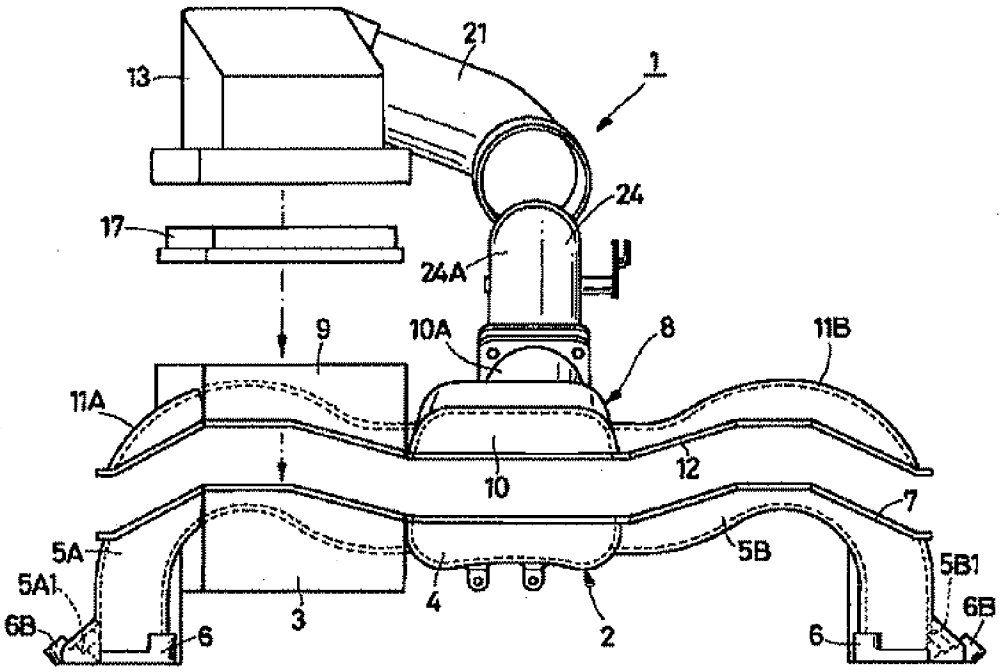
【図２】


1
19
13
17
11A
14
11A
8
9
A
12
5A
7
18
16A
16A
5A
3
20
2
6

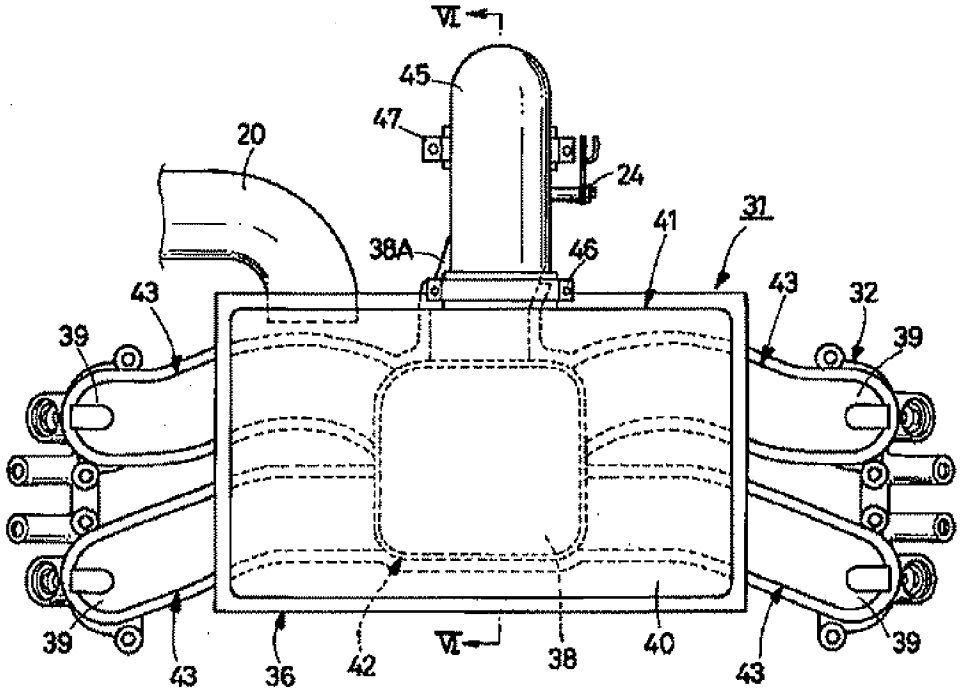
【図３】


1
14
10A
13
25
24
23
21
22
15
10
B
9
8
11A
C
C
12
7
5A
3
4
16A
5A
11A
25
24B
24A
16A
2
6

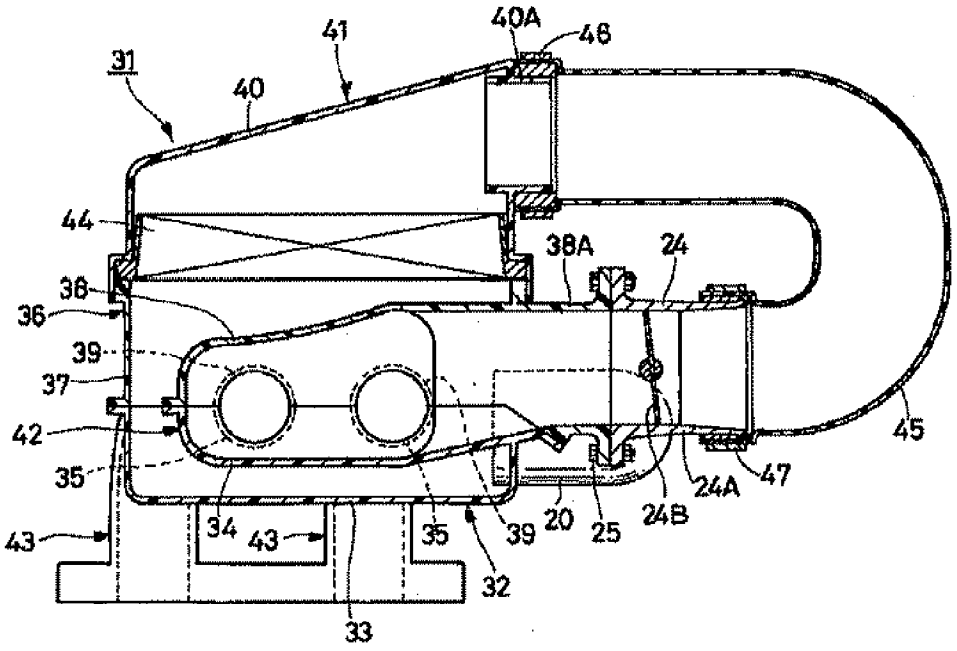
【図４】


21
13
1
24
17
24A
9
10A
8
11B
11A
10
12
7
5A
5B
5B1
5A1
6B
3
4
2
6
6B

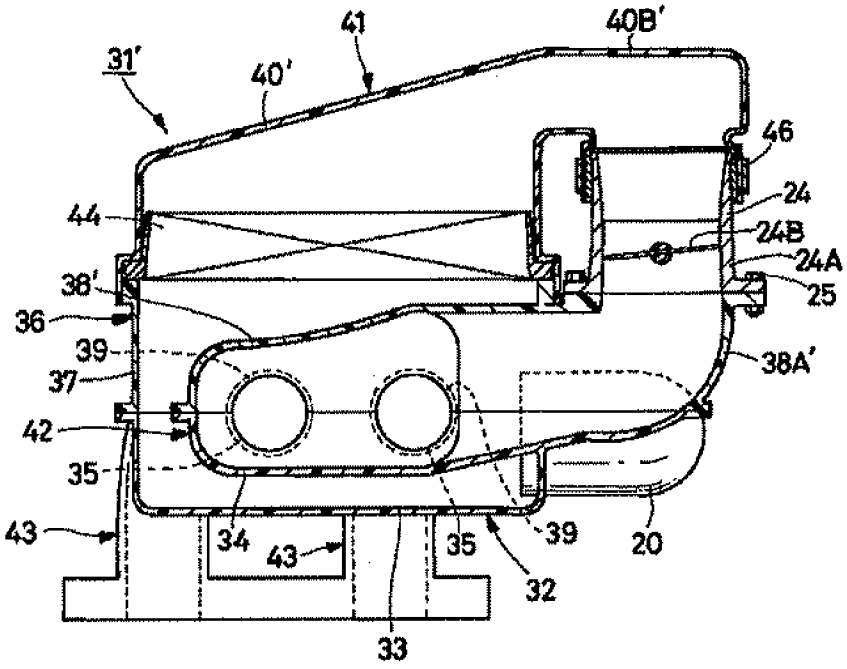
【図５】


VI
45
47
20
24
41
31
38A
46
43
32
39
43
39
39
43
36
42
VI
38
40
43
39

【図６】


31
40
41
40A
46
44
38A
24
38
36
39
37
42
35
45
24A
47
43
34
43
35
39
20
25
24B
32
33

【図７】


31'
40'
41
40B'
46
24
24B
24A
25
44
38'
36
39
37
38A'
42
35
43
34
43
35
39
20
32
33